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(54) **Floor covering, consisting of hard floor panels and method for manufacturing such floor panels**  
Bodenbelag, bestehend aus harten Bodenplatten und Verfahren zur Herstellung solcher Bodenplatten  
Revêtement de sol composé de panneaux de plancher durs et procédé de fabrication de ces panneaux de plancher

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at least of a portion which inwardly slopes downward; and that, preferably, this portion, at least partially, is located in the portion of the lower lip which extends beyond the upper lip. The advantages of these features will appear from the further description.

[0020] According to a preferred form of embodiment, the floor panels consist of elongated panels and the coupling parts described above are applied along the longitudinal sides of these panels.

[0021] According to a particular form of embodiment, coupling parts are provided at the other two sides, too, either of another construction than described above or not.

[0022] In the most preferred form of embodiment, for the basic material use shall be made of the aforementioned product, which, as said, is ground and, by means of a binding agent, composed to a single compound. More particularly, for the core use shall be made of finely-ground wood which preferably is glued, more particularly, watertight glued. Still more particularly, for the core use shall be made of so-called HDF board (High Density Fibreboard) or MDF (Medium Density Fibreboard).

[0023] The fact that the invention is applied to floor panels the basic material of which consists of the material described above, offers the advantage that with the processing of this material, very smooth surfaces are obtained whereby very precise couplings can be realized, which, in first instance, is important in the case of a snap-together connection and/or turning connection free from play. Also, very special forms of coupling parts can be manufactured in a very simple manner because the aforementioned kinds of material can be processed particularly easy.

[0024] The surfaces obtained with HDF and MDF also have the advantage that the floor panels mutually can fluently be shifted alongside each other in interlocked condition, even when engaged with a tensioning force.

[0025] The inventor also found out that the aforementioned materials, in particular HDF and MDF, show ideal features in order to realize a connection, such as mentioned above, as these materials show the right features in respect to elastic deformation in order to, on one hand, realize a snap-together effect, and, on the other hand, receive expansion and shrinkage forces in an elastic manner, whereby it is avoided that the floor panels come unlocked or are damaged in an irreparable manner.

[0026] In the case that for the core use is made of a material based on synthetic material, to this end solid synthetic material can be used as well as a mixture of synthetic materials, eventually composed of recycled materials.

[0027] Other features of the floor covering, as well as of the floor panels for realizing such floor covering, providing in a further optimization, can be derived from the enclosed subclaims 2 to 20 and 22.

[0028] The floor covering preferably is formed by join-

ing the floor panels into each other free of glue. Hereby, the connections are of such nature that the floor panels can be disassembled without being damaged, such that, for example, when moving, they can be taken along in order to be placed again. It is, however, clear that a glue-  
5 ing between tongue and groove is not excluded.

[0029] The invention also relates to a method for the manufacturing of the aforementioned floor panels which shows the advantage that the tongues and/or grooves, including the corresponding locking means, can be provided at the floor panels at high production speeds without problems. More particularly, it aims at a method which allows that the rather complicated forms of the tongue and the groove of the aforementioned floor panels can be realized, such that the use of small milling cutters, for example finger cutters, with diameters smaller than the depth of the tongue or groove can be excluded.  
10 15

[0030] To this aim, this method shows the characteristic that the tongue and/or groove is realized by means of a milling process with at least two subsequent milling cycles by means of milling cutters which are positioned in different angles in respect to the related floor panel. During each of the aforementioned milling cycles, preferably substantially the final form of one flank, either of the tongue or of the groove, is realized.  
20 25

[0031] For the aforementioned two milling cycles, thus, milling cutters are used which extend outside the groove, respectively the tongue. More particularly the diameters of these milling cutters shall at least be 5 times and even better 20 times larger than the thickness of the floor panels.  
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[0032] The use of milling cutters showing the aforementioned diameters has as an advantage that the normal production speeds can be maintained which are also applied during milling of a classical straight tongue and groove. There is also the advantage obtained that the installation of such milling cutters induce only minor or no additional costs because such milling cutters can be placed directly upon a motor shaft and/or the usual machines can be used.  
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[0033] With the intention of better showing the characteristics according to the invention, in the following, as an example without any limitative character, several preferred forms of embodiment are described, with reference to the accompanying drawings, wherein:  
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figure 1 represents a floor panel of a floor covering according to the invention;

figure 2, on a larger scale, represents a cross-section according to line II-II in figure 1;

figures 3 and 4 represent how two floor panels with coupling parts according to figure 2 match into each other;

figure 5, on a larger scale, represents a cross-section according to line V-V in figure 1;

figures 6 and 7 represent how two floor panels with coupling parts according to figure 5 match into each  
50 55

ably also realized in the shape of a tongue 31 and a groove 32. Hereby, the locking means 30 do not have to be of the same nature as the locking means 6.

**[0050]** Preferably, at the sides 26-27 locking means are applied which allow for an engagement and interlocking by means of a translation movement T only, as represented in figures 6 and 7. To this aim, the locking means 30 consist of a snap-together connection with locking elements 33 and 34 which grip behind each other.

**[0051]** As represented in figures 5 to 7, the locking element 33 preferably consists of a protrusion of the lower side 35 of the tongue 31 which can take place in a recess 36 in the lower wall 37 of the groove 32. The locking element 34 is formed by the upward directed part which limits the recess 36.

**[0052]** In this case, the locking elements 33-34 have contact planes 38-39 which are parallel to each other and preferably extend in an inclined manner, according to a direction which simplifies the snapping-together. The tangent line L which is determined by the contact planes 38-39, hereby forms an angle A with the underside 7 which is smaller than 90°.

**[0053]** The locking elements 33-34 preferably are provided with inclined portions 40 and 41 which, when engaging two floor panels 1, cooperate with each other in such a manner that the locking elements 33-34 can easily be pushed over each other until they grip behind each other by means of a snap-together effect.

**[0054]** The thickness W1 of the tongue 31 preferably is equal to the width W of the groove 32, such that the upper lip 42, when exerting a pressure P, is supported by the tongue 31 which, in its turn, then is supported by the lower lip 43.

**[0055]** Analogous to the chamfer 24 and recess 25, a recess 44 and a chamfer 45 are provided also at the edges 28-29.

**[0056]** It is noted that such a snap-together coupling can also be applied at the edges 2-3. Hereby, this can be a snap-together coupling analogous to these of figures 5 to 7, but this can also be a snap-together coupling whereby other forms of coupling parts are applied, for example, such as represented in figures 8 and 9. Contrary to the locking elements 33-34 which consist of rather local protrusions, in the forms of embodiment of figures 8 and 9 use is made of locking elements 46-47 which, in comparison to the total width B of the coupling, extend over a rather large distance.

**[0057]** In this case, the locking elements 46-47 are also provided at the lower side 12 of the tongue 9 and the lower wall 14 of the groove 10.

**[0058]** According to figure 8, the locking elements 46-47 have contact surfaces 48-49 which are at an angle with the plane of the floor panel 1. Hereby, a coupling is obtained which is interlocked in a particularly fixed manner.

**[0059]** As represented in figure 9, the locking elements 46-47 possibly can be realized in such a manner

that substantially only a linear contact is obtained, for example, because the contact surfaces directed towards each other are realized with different curvatures.

**[0060]** The surfaces, directed towards each other, of the locking elements 46-47 hereby consist of bent surfaces. The tangent line L forms an angle A which is smaller than 90°, and even better is smaller than 70°.

**[0061]** Hereby, the locking element 46 preferably has two portions with a different curvature, on one hand, a portion 50 with a strong curvature and, on the other hand, a portion 51 with a weak curvature. The portion 50 with the strong curvature provides for the formation of a firm coupling. The portion 51 with the weak curvature allows that the coupling parts 4-5 can be brought into each other easily. The intermediate space S forms a chamber which offers space for dust and similar which, when engaging two floor panels 1, gets there eventually.

**[0062]** In the case of a snap-together connection, for example, a connection, such as represented in figures 7 to 9, preferably always the tongue 9-31 has a shape, thickening towards below, which can cooperate with a widened portion in the groove 10.

**[0063]** In figure 10, a variant is represented whereby at least at the height of the upper edges 15-16, a sealing material 52 is provided, as a result of which a watertight sealing can be guaranteed. This sealing material 52 may consist of a strip or covering which is provided previously at the floor panel 1, either at one or both upper edges 15-16.

**[0064]** In figure 11, a further variant is represented, whereby the locking means 6 are formed by an upward directed portion 53 at the tongue 9 which, as a result of a turning movement, is brought behind a downward-directed portion 54 at the upper wall 18. More particularly, this is obtained by realizing the upper side 17 and the upper wall 18 with a curvature R3, the center of which is situated at the edges 15-16, and realizing the lower side 12 and the lower wall 14 with a radius R4, the center of which is also situated at the upper edges 15 and 16, respectively. These radii R3-R4 can be chosen otherwise, too.

**[0065]** In general, according to the invention, the difference between, on one hand, the radius R1, R3 respectively, and, on the other hand, the radius R2, R4 respectively, preferably should not be larger than 2 mm.

**[0066]** It is also preferred that the center of these radii is situated inside the circle C1, C2 respectively, which extends with a radius R5 of 3 mm around the upper edge 15, 16 respectively, such as, for example, indicated in figure 2.

**[0067]** Finally is noted that, according to the invention, the lower lip 23-43, as represented in figures 2 to 7, can be realized longer than the upper lip 22-42. This has as an advantage that the coupling parts 4-5-28-29 can be realized in an easier manner by means of a milling cutter or such. Furthermore, this simplifies the engagement of two floor panels 1, because each subsequent floor panel 1 during installation can be placed upon the protruding

means 6 which, in engaged condition, exert a tension force upon each other, as a result of which the engaged floor portions 1 are forced towards each other. As represented, this is realized preferably by providing the coupling parts with an elastically bendable portion, in this case the lip 43, which, in engaged condition, is at least partially bent and in this way creates a tension force which provides for that the engaged floor panels 1 are forced towards each other. The hereby resulting bending V, as well as the tension force K resulting herefrom, are indicated in the enlargement of figure 23.

[0087] In order to obtain that the tension force K results in pressing together the engaged floor panels 1, the bendable portion, in this case the lip 43, preferably is provided, as represented, with an inwardly inclined contact surface 73 which preferably can cooperate with a corresponding contact surface 74. These contact surfaces 73-74 are similar to the aforementioned contact surfaces 39-38 and also similar to the inclined portions of the lower lip of figures 2 to 4.

[0088] In the figures 2 and 5, the portions form complementary matching shapes; it is, however, clear that, by a modification, also a tension effect similar as in figure 23 can be realized.

[0089] Due to, on one hand, the contact under the angle A, and, on the other hand, the fact that a tension force K is created, a force component K1 is effected, as a result of which the floor panels 1 are drawn against each other.

[0090] Preferably, the angle A of the contact surfaces 73-74 in respect to the horizontal plane is situated between 30 and 70 degrees. In first instance in the case that use is made of the embodiment whereby a tension force K is realized, an angle A of 30 to 70 degrees is ideal in order, on one hand, to effect an optimum pressing-together of the floor panels 1 and, on the other hand, to obtain that the floor panels 1 can easily be engaged, respectively disassembled.

[0091] Although the pressing force K1 preferably is delivered by the aforementioned lip 43, the invention does not exclude other forms of embodiment whereby this force is delivered by other bendable portions.

[0092] It is noted that the bending V is relatively small, for example, several hundredths up to several tenths of a millimeter, and does not have an influence upon the placement of the floor covering. Furthermore is noted that such floor covering generally is placed upon an underlayer which is elastically compressible, as a result of which the bending V of the lip 43 exclusively results in the fact that the underlayer locally is compressed somewhat more.

[0093] Due to the fact that the lip 43 is bent apart and that it remains somewhat bent apart in engaged position, also the advantage is effected that, when exerting a pressure upon the floor covering, for example, when placing an object thereupon, the pressing-together force is enhanced and, thus, the development of gaps is counteracted even more.

[0094] It is noted that the inventor has found that, contrary to all expectations, an ideal tension force can be realized by manufacturing the coupling parts 4-5, including the locking elements 33-34, and preferably the complete core 8, of HDF board or MDF board, although these materials only allow a minor elastic deformation.

[0095] HDF and MDF also offer the advantage that smooth surfaces are obtained, as a result of which the locking elements can be moved easily over each other.

[0096] According to a variant of the invention, the tension force can also be delivered by means of an elastic compression of the material of the coupling parts, to which end these coupling parts, and preferably the complete core 8, then have to be manufactured in an elastically compressible material.

[0097] A further particular characteristic of the embodiment of figures 22 to 25 consists in that the floor panels 1 can be engaged by means of a turning movement, as represented in figure 24, as well as by means of shifting them towards each other, as represented in figure 25, preferably in such a manner that, during the engagement by means of the turning movement, a maximum bending Vm results in the coupling parts, more particularly in the lip 43, which bending Vm is less pronounced, if not non-existent, as in the figures 2 to 4, in comparison to the bending Vm which results when the floor panels 1 are engaged by means of shifting them towards each other.

[0098] The advantage of this consists in that the floor panels 1 can be engaged easily by means of a turning movement, without necessitating a tool therefore, whereas it still remains possible to engage the floor panels also by means of shifting them. This latter is useful, in first instance, when the last panel has to be placed partially under a door frame or similar. In this case, the floor panel 1 can be pushed under the door frame with the side which does not have to be engaged and subsequently, possibly by means of tools, can be snapped into the adjacent floor panel 1.

[0099] It is noted that the shapes of the coupling parts 4-5 shown in figures 22 to 25 can also be used for the coupling parts 28-29 of the short sides.

[0100] According to the invention, in the case that the four sides 2-3-26-27 are provided with coupling parts 4-5-28-29, these coupling parts can be realized in such a manner that in one direction a firmer engagement than in the other direction is effected. In the case of elongated floor panels 1, for example, such as represented in figure 1, the locking at the small sides 26-27 preferably shall be more pronounced than at the longitudinal sides 2-3. The length of the coupling at the small sides, namely, is smaller and, in principle, less firm. This is compensated by providing in a more pronounced locking.

[0101] This difference in engagement can be obtained by realizing the contact surfaces 73-74 under different angles.

[0102] Preferably, the aforementioned protrusion, more particularly the locking element 33, is bordered by

2-3 and/or 26-27 with a surface densifying agent, more particularly a surface hardening agent, which preferably is chosen from the following series of products: impregnation agents, pore-sealing agents, lacquers, resins, oils, paraffines and similar.

[0111] In figure 22, such impregnation 88 is represented schematically. This treatment can be performed over the complete surface of the sides 2-3 and/or 26-27 or only over well-defined portions hereof, for example, exclusively the surfaces of the tongue 9 and the groove 10.

[0112] The treatment with a surface densifying agent offers, in combination with the snap-together effect, the advantage that in various aspects better coupling features are obtained. As a result of this, the coupling parts 4-5 and/or 28-29 better keep their shape and strength, even if the floor panels 1 are engaged and disassembled repeatedly. Especially in the case that for the core 8 use is made of HDF, MDF or similar, by means of this treatment such a better quality of surface condition is obtained, that no abrasion of material occurs during engaging, respectively during disassembling.

[0113] This treatment also offers the advantage that, at least in the case of a surface hardening, the aforementioned elastic tensioning effect is enhanced.

[0114] The present invention is in no way limited to the forms of embodiment described by way of example and represented in the figures, however, can such floor covering and the pertaining floor panels 1 be realized in various forms and dimensions within the terms of the appended claims.

[0115] For example, the various characteristics which are described by means of the represented forms of embodiment, may be combined with each other or not.

[0116] Furthermore, all embodiments of coupling elements described before can be applied at the longer side as well as at the shorter side.

#### Claims

1. Hard floor panel, for realizing a floor covering, whereby this floor panel (1) at least at the edges of two opposite sides (2-3, 26-27) is provided with coupling parts (4-5, 28-29), which allow that two of such panels can co-operate with each other, whereby these coupling parts (4-5, 28-29) are substantially in the form of a tongue (9-31) and a groove (10-32) and whereby these coupling parts are provided with integrated mechanical locking means (6) made in one piece with the panel (1) which, when two of such panels (1) are coupled to each other, prevent the drifting apart of these floor panels (1) into a direction (R) perpendicular to the related edges (2-3, 26-27) and parallel to the underside (7) of the coupled floor panels (1), **characterized in that** the coupling parts (4-5, 28-29) are provided with means which, in the engaged condition of two or more of such floor panels (1), exert a tension force upon each other which forces the floor panels (1) towards each other, said means comprising an elastically bendable portion which, in the engaged condition, is at least partially bent and in this manner provides the aforementioned tension force.
2. Floor panel according to claim 1, **characterized in that** the coupling parts and locking means are configured such that, when two of such panels are coupled to each other, in the engagement direction, apart from a contact formed by contact surfaces (38-39, 73-74) delivering the tension force, there exists only one substantial contact point between two coupled floor panels (1), which is formed by a section (84) at the location of the top side of the floor panels (1).
3. Floor panel according to claim 1 or 2, **characterized in that** the elastically bendable portion consists of a lip, preferably the lip (23-43) limiting the lower side of the aforementioned groove (10).
4. Floor panel according to claim 3, **characterized in that** the bendable portion which, in coupled condition of two of such panels, is bent out in coupled condition is formed by the lower lip (23-43) of said groove (10-32) whereby this lip (23-43) in coupled condition is bent out only downwardly.
5. Floor panel according to claim 3 or 4, **characterized in that** the bendable portion is provided with a contact surface (39-73) which inwardly slopes downward.
6. Floor panel according to claim 5, **characterized in that**, when coupled to a similar panel, said contact surface (39-73) co-operates with a corresponding contact surface (38-74) and **in that** said co-operating contact surfaces define a tangent line (L) which forms an angle (A) with the underside (7) of the floor panels (1) which is 30° to 70°.
7. Floor panel according to any of the claims 3 to 6, **characterized in that** the locking means (6) at least consist of, on the one hand, a recess (13-36) which is provided in said lip (23-43), more particularly in the lower lip (23-43) which borders said groove, and, on the other hand, a protrusion which is located at said tongue (9-31), whereby, in coupled condition of two panels (1), the protrusion of one of said panels (1) co-operates with the recess of the other panel (1), said recess and protrusion defining contact surfaces (38-39, 73-74), the contact of which results in said tension force.
8. Floor panel according to claim 7, **characterized in**

of such panels (1) can be assembled by applying the steps of:

- laying a first of said hard floor panels (1); and
  - coupling a second panel to said first panel, by fitting the tongue and groove into each other, thereby providing that the lower lip is bent out in coupled condition, such that said lip, by means of the inclined portions provides in a force by which the panels (1) are permanently urged towards each other.
21. Floor covering, **characterised in that** it is composed of a plurality of panels as described in any of claims 1 to 20.
22. Floor covering according to claim 21, **characterized in that** the floor panels (1) are connected free of glue, such that they can be disassembled and be re-used.
23. Method for manufacturing floor panels according to any of claims 1 to 20, **characterized in that** the tongue (9-31) and/or groove (10-32) is realized by means of a milling process with at least two subsequent milling cycles by means of milling cutters (63-64-65-66-67-68-69-70) which are positioned in different angles in respect to the related floor panel (1).
24. Method according to claim 23, **characterized in that** during each of the aforementioned milling cycles each time substantially the final shape of one flank (71-72), either of the tongue or to the groove, is realized.
25. Method according to claim 23 or 24, **characterized in that** for the aforementioned two milling cycles milling cutters (63-64-65-66-67-68-69-70) are applied which extend outside the groove (10-32), respectively the tongue (9-31), and more particularly show diameters (G) which are at least 5 times larger than the thickness (F) of the floor panels (1), and preferably even at least 20 times larger than the thickness (F) of the floor panels (1).
26. Method according to any of the claims 23 to 25, **characterized in that** at all four sides of the floor panel (1) a profile is provided and that the floor panels (1) are displaced according to two perpendicular movements (V1-V2), whereby during one of the movements profiles at two opposite edges are provided, whereas during the other movement profiles are provided at the small edges.

## Patentansprüche

1. Hartes Fußbodenpaneel zur Verwirklichung eines Fußbodenbelags, wobei dieses Fußbodenpaneel (1) zumindest an den Kanten zweier einander gegenüberliegender Seiten (2-3, 26-27) mit Koppelteilen (4-5, 28-29) versehen ist, die gestatten, dass zwei derartige Paneele miteinander zusammenwirken können, wobei diese Koppelteile (4-5, 28-29) im Wesentlichen in Form einer Nut (10-32) und einer Feder (9-31) vorliegen und wobei diese Koppelteile mit einstückig mit dem Paneel (1) gefertigten integrierten mechanischen Verriegelungsmitteln (6) versehen sind, die, wenn zwei derartige Paneele (1) miteinander gekoppelt sind, das Auseinanderschieben dieser Fußbodenpaneele (1) in eine Richtung (R) senkrecht zu den betreffenden Kanten (2-3, 26-27) und parallel zur Unterseite (7) der gekoppelten Fußbodenpaneele (1) verhindern, **dadurch gekennzeichnet, dass** die Koppelteile (4-5, 28-29) mit Mitteln versehen sind, die im zusammengefügte Zustand zweier oder mehr derartiger Fußbodenpaneele (1) eine Spannkraft aufeinander ausüben, die die Fußbodenpaneele (1) zueinander zwingt, wobei besagte Mittel einen elastisch verbiegbaren Teil umfassen, der im zusammengefügte Zustand zumindest teilweise verbogen ist und auf diese Weise die vorgenannte Spannkraft bereitstellt.
2. Fußbodenpaneel gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Koppelteile und Verriegelungsmittel derart konfiguriert sind, dass, wenn zwei derartige Paneele miteinander gekoppelt sind, in der Eingreifrichtung außer einem von Kontaktflächen (38-39, 73-74), die die Spannkraft liefern, gebildeten Kontakt nur ein wesentlicher Kontaktpunkt zwischen zwei gekoppelten Fußbodenpaneelen (1) besteht, der von einem Abschnitt (84) an der Oberseite der Fußbodenpaneele (1) gebildet wird.
3. Fußbodenpaneel gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der elastisch verbiegbare Teil aus einer Lippe besteht, vorzugsweise der Lippe (23-43), die die Unterseite der vorgenannten Nut (10) begrenzt.
4. Fußbodenpaneel gemäß Anspruch 3, **dadurch gekennzeichnet, dass** der verbiegbare Teil, der, in gekoppeltem Zustand zweier derartiger Paneele, in gekoppeltem Zustand nach außen gebogen ist, von der unteren Lippe (23-43) besagter Nut (10-32) gebildet wird, wobei diese Lippe (23-43) in gekoppeltem Zustand nur nach unten nach außen gebogen wird.
5. Fußbodenpaneel gemäß Anspruch 3 oder 4, **dadurch gekennzeichnet, dass** der verbiegbare Teil

*falsche  
hier durch  
"bent out"*

- reitstellenden Mittel an beiden Kantenpaaren integriert sind, sodass die Paneele (1) in zusammengefügtm Zustand an allen gekoppelten Kanten zueinander gezwungen werden.
18. Fußbodenpaneel gemäß einem der vorgenannten Ansprüche, **dadurch gekennzeichnet, dass** die Paneele (1) zumindest an zwei gegenüberliegenden Seiten mit Koppelteilen versehen sind, die es gestatten, die Paneele (1) an diesen Kanten zumindest durch Verdrehen zu koppeln, wobei als Ergebnis des Nach-unten-Schwenkens der Paneele (1) der elastisch verbiegbare Teil verbogen wird; und dass die Paneele (1) zumindest an den zwei anderen gegenüberliegenden Kanten mit Koppelteilen versehen sind, die es gestatten, die Paneele (1) an diesen Kanten zumindest durch Verschieben zu koppeln, wobei als Ergebnis dieses Verschiebens auch der elastisch verbiegbare Teil an diesen Kanten in einem gebogenen Zustand bleibt.
19. Fußbodenpaneel gemäß einem der vorgenannten Ansprüche, **dadurch gekennzeichnet, dass** die Fußbodenpaneele (1) als Laminatfußboden verwirklicht sind, wobei auf dem Kern (8) eine oder mehr Schichten, worunter eine dekorative Schicht (55), die besagte dekorative Oberfläche bildet, angebracht sind und wobei an der Unterseite (7) eine Unterlage (58) angebracht ist.
20. Fußbodenpaneel gemäß einem der Ansprüche 1 bis 19, zur Verwirklichung eines Fußbodenbelags, wobei die untere Seite der Nut (10) begrenzende untere Lippe (23-43) sich über die obere Lippe (22-42) hinaus erstreckt und wobei besagte Verriegelungsmittel (6) einen Teil umfassen, der innen nach unten geneigt ist, welcher Teil, zumindest teilweise, in dem sich über die obere Lippe (22-42) hinaus erstreckenden Teil der unteren Lippe (23-43) gelegen ist, wobei dieser Teil, im gekoppelten Zustand zweier derartiger Paneele (1), mit einer Oberfläche an der Unterseite der Feder zusammenwirkt, die ebenfalls geneigt ist, und wobei besagte Koppelmittel und integrierte Verriegelungsmittel derart konfiguriert sind, dass zwei derartige Paneele (1) zusammengefügt werden können, indem die Schritte angewendet werden des:
- Verlegens eines ersten der besagten harten Fußbodenpaneele (1); und
  - Koppelns eines zweiten Paneels an besagtes erstes Paneel, indem die Feder und die Nut ineinandergefügt werden, wobei dafür gesorgt wird, dass die untere Lippe in gekoppeltem Zustand nach außen gebogen ist, sodass besagte Lippe, mittels der geneigten Teile, eine Kraft bereitstellt, durch welche die Paneele (1) permanent zueinander gezwungen werden.
21. Fußbodenbelag, **dadurch gekennzeichnet, dass** er aus einer Vielzahl von Paneelen zusammengesetzt ist, wie in einem der Ansprüche 1 bis 20 beschrieben.
22. Fußbodenbelag gemäß Anspruch 21, **dadurch gekennzeichnet, dass** die Fußbodenpaneele (1) leimfrei verbunden werden, sodass sie auseinandergenommen und erneut verwendet werden können.
23. Verfahren zur Herstellung von Fußbodenpaneelen gemäß einem der Ansprüche 1 bis 20, **dadurch gekennzeichnet, dass** die Feder (9-31) und/oder Nut (10-32) mittels eines Fräsprozesses mit zumindest zwei aufeinanderfolgenden Fräsvorgängen mittels Fräsen (63-64-65-66-67-68-69-70) verwirklicht wird, die in Bezug zu dem betreffenden Fußbodenpaneel (1) unter verschiedenen Winkeln positioniert sind.
24. Verfahren gemäß Anspruch 23, **dadurch gekennzeichnet, dass** während jedes der vorgenannten Fräsvorgänge jedesmal im Wesentlichen die endgültige Form einer Flanke (71-72), entweder der Feder oder der Nut, verwirklicht wird.
25. Verfahren gemäß Anspruch 23 oder 24, **dadurch gekennzeichnet, dass** für die besagten zwei Fräsvorgänge Fräsen (63-64-65-66-67-68-69-70) verwendet werden, die sich außerhalb der Nut (10-32) beziehungsweise der Feder (9-31) erstrecken und spezieller Durchmesser (G) aufweisen, die zumindest 5 Mal größer sind als die Dicke (F) der Fußbodenpaneele (1) und vorzugsweise sogar zumindest 20 Mal größer sind als die Dicke (F) der Fußbodenpaneele (1).
26. Verfahren gemäß einem der Ansprüche 23 bis 25, **dadurch gekennzeichnet, dass** an allen vier Seiten des Fußbodenpaneels (1) ein Profil vorgesehen ist und dass die Fußbodenpaneele (1) gemäß zwei senkrechten Bewegungen (V1-V2) bewegt werden, wobei während einer der Bewegungen Profile an zwei gegenüberliegenden Kanten angebracht werden, wohingegen während der anderen Bewegung Profile an den Schmalseiten angebracht werden.

#### 50 Revendications

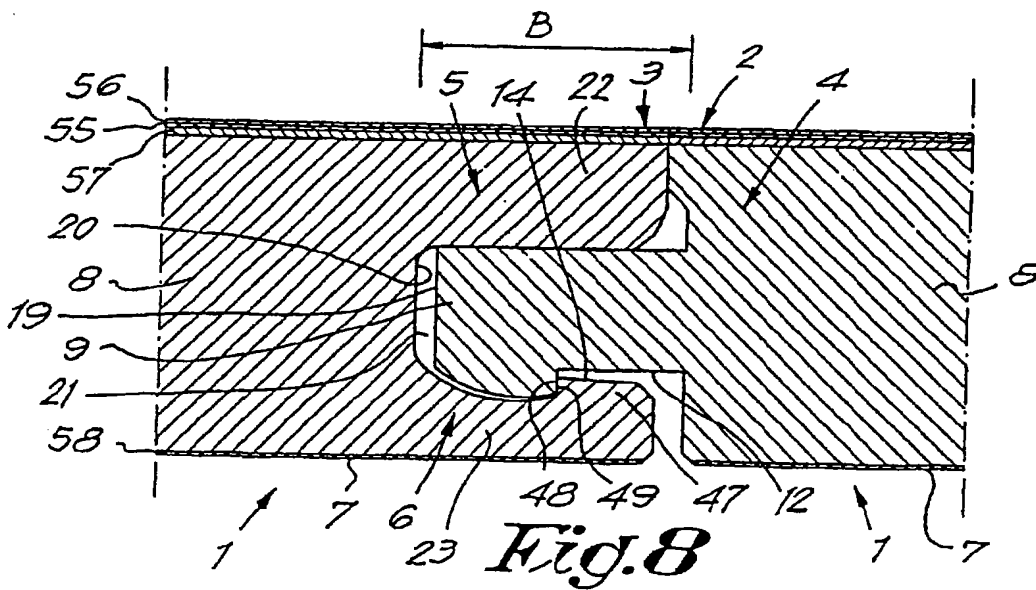
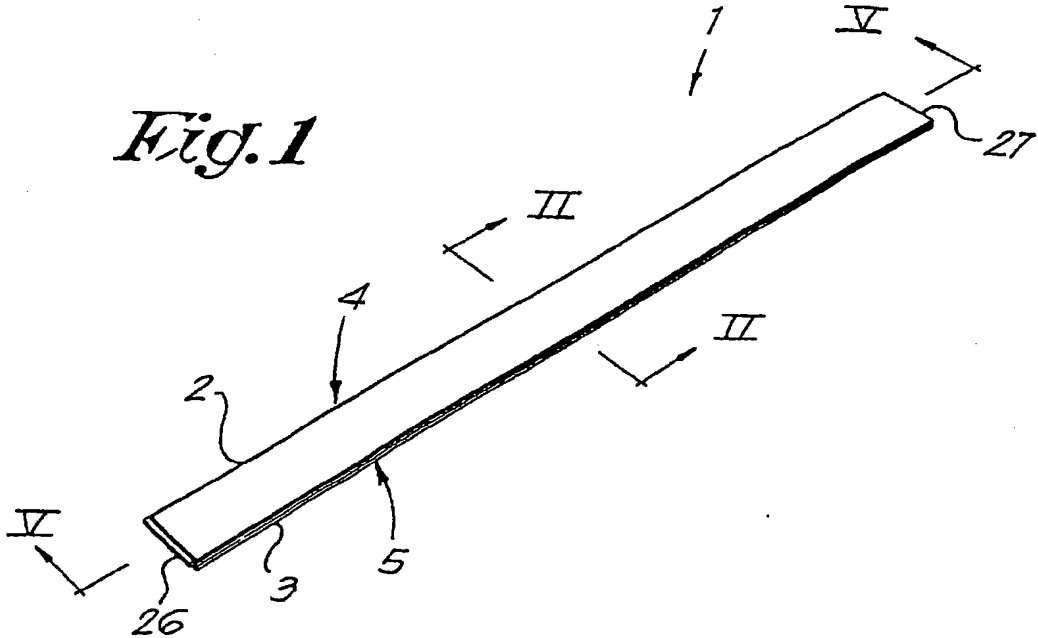
1. Panneau de sol dur pour réaliser un recouvrement de sol, ce panneau de sol (1), au moins aux bords de deux côtés opposés (2 - 3, 26 - 27), étant muni d'éléments d'accouplement (4 - 5, 28 - 29) qui confèrent à deux panneaux de ce type la capacité de coopérer l'un avec l'autre, ces éléments d'accouplement (4 - 5, 28 - 29) se présentant essentiellement

délimitant le côté inférieur de la rainure (11 - 32) s'étend au-delà de la lèvre (22 - 42) délimitant le côté supérieur de la rainure (10 - 32).

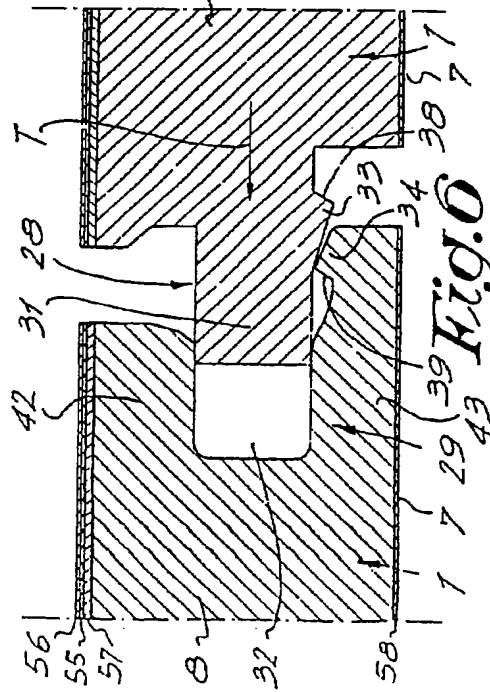
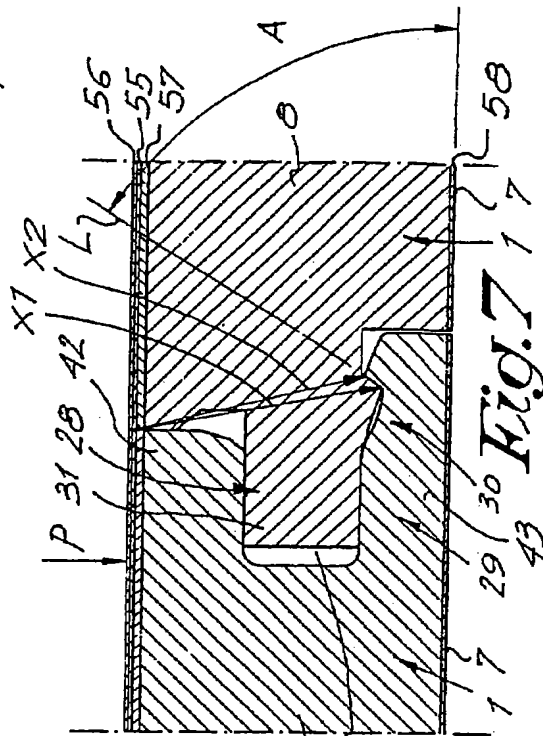
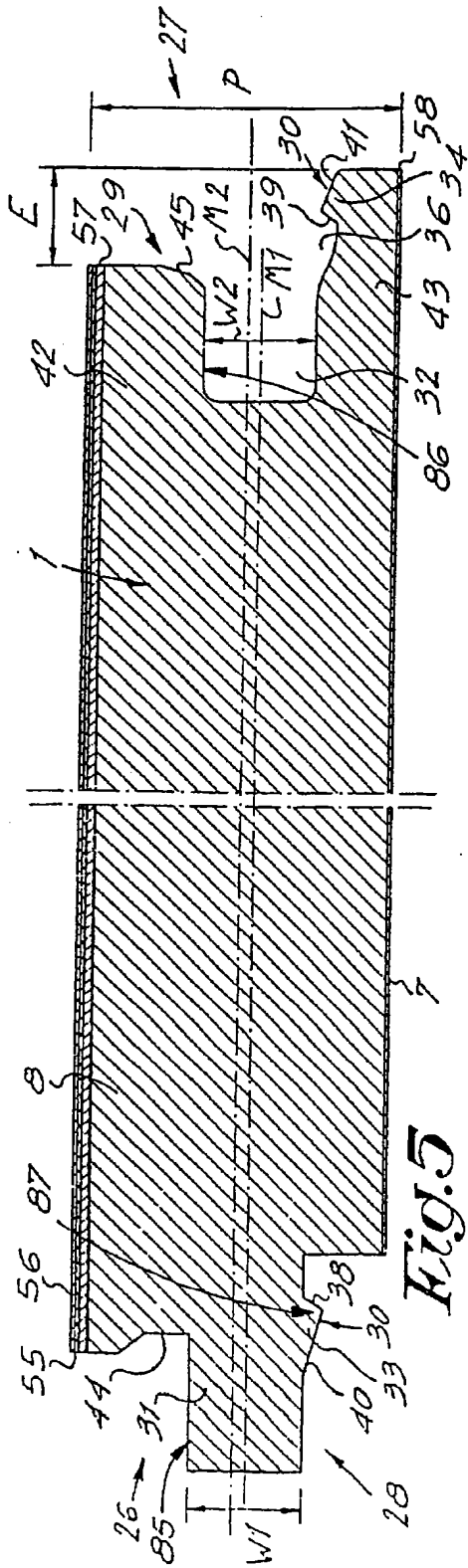
12. Panneau de sol selon la revendication 11, **caractérisé en ce que** la lèvre inférieure s'étend au-delà de la lèvre supérieure, la différence (E) entre les lèvres, mesurée dans le plan du panneau de sol, étant inférieure à une fois l'épaisseur totale (F) du panneau de sol (1). 5
13. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens de verrouillage (6) comprennent des éléments de verrouillage (13 - 34) qui sont disposés dans la portion de la lèvre inférieure (23 - 43), qui s'étend au-delà de la lèvre supérieure (22 - 42). 10
14. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les éléments d'accouplement (4 - 5, 28 - 29) possèdent une configuration telle que deux panneaux de sol successifs (1) peuvent venir s'insérer l'un dans l'autre en les déplaçant latéralement de manière conjointe et en les faisant tourner, pour obtenir ainsi en particulier une action d'encliquetage réciproque. 15
15. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la rainure est délimitée par une lèvre supérieure et par une lèvre inférieure, et **en ce que** la lèvre inférieure (23 - 43) possède une épaisseur qui est inférieure à l'épaisseur de la lèvre supérieure (22 - 42). 20
16. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les panneaux (1) possèdent une partie centrale constituée d'un panneau HDF ou d'un panneau MDF, lesdits moyens d'accouplement, y compris ladite portion apte à plier, étant formés essentiellement à partir dudit panneau, de telle sorte que la force de tension est fournie par l'élasticité du HDF ou du MDF. 25
17. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les panneaux (1) sont rectangulaires ; **en ce que** les panneaux (1) sont munis d'éléments d'accouplement et de moyens de verrouillage (6) aux deux paires de bords opposés ; et **en ce que** les moyens procurant la force de tension sont intégrés aux deux paires de bord, de telle sorte que les panneaux (1) à l'état inséré sont forcés en direction l'un de l'autre à tous les bords accouplés. 30
18. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les panneaux (1), au moins à deux bords opposés, sont munis d'éléments d'accouplement qui permettent d'accoupler les panneaux (1) à ces bords au moins par rotation, le pliage de la portion apte à plier de manière élastique résultant du fait de la rotation des panneaux (1) vers le bas ; et **en ce que** les panneaux (1), au moins aux deux autres bords opposés, sont munis d'éléments d'accouplement qui permettent d'accoupler les panneaux (1) à ces bords, au moins par déplacement, la portion apte à plier de manière élastique restant, suite à ce déplacement, à ces bords, également à l'état plié. 35
19. Panneau de sol selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les panneaux de sol (1) sont réalisés sous la forme d'un recouvrement de sol stratifié, une ou plusieurs couches, dont une couche décorative (55) formant ladite surface décorative, étant prévues sur la partie centrale (8), et une couche dorsale (58) étant prévue sur le côté inférieur (7). 40
20. Panneau de sol selon l'une quelconque des revendications 1 à 19, pour réaliser un recouvrement de sol, la lèvre inférieure (23 - 43) qui limite le côté inférieur de la rainure (10) s'étendant au-delà de la lèvre supérieure (22 - 42), et lesdits moyens de verrouillage (6) comprenant une portion qui est inclinée vers le bas en étant orientée vers l'intérieur, ladite portion, au moins en partie, étant disposée dans la portion de la lèvre inférieure (23 - 43) qui s'étend au-delà de la lèvre supérieure (22 - 42), cette portion, à l'état accouplé de deux panneaux (1) de ce type, coopérant avec une surface sur le côté inférieur de la languette, qui est également inclinée, et en ce que lesdits moyens d'accouplement et lesdits moyens de verrouillage intégrés sont configurés de telle sorte que l'on peut assembler deux panneaux (1) de ce type en passant par les étapes consistant à : 45
- poser un premier panneau desdits panneaux de sols (1); et
  - accoupler un deuxième panneau audit premier panneau, via une insertion réciproque de la languette et de la rainure, pour ainsi obtenir un pliage de la lèvre inférieure vers l'extérieur à l'état accouplé, de telle sorte que ladite lèvre, au moyen des portions inclinées, génère une force par laquelle les panneaux (1) sont pressés en permanence l'un vers l'autre. 50
21. Recouvrement de sol, **caractérisé en ce qu'il** est composé par plusieurs panneaux tels qu'on les décrit dans l'une quelconque des revendications 1 à 20. 55
22. Recouvrement de sol selon la revendication 21, **caractérisé en ce que** les panneaux de sol (1) sont

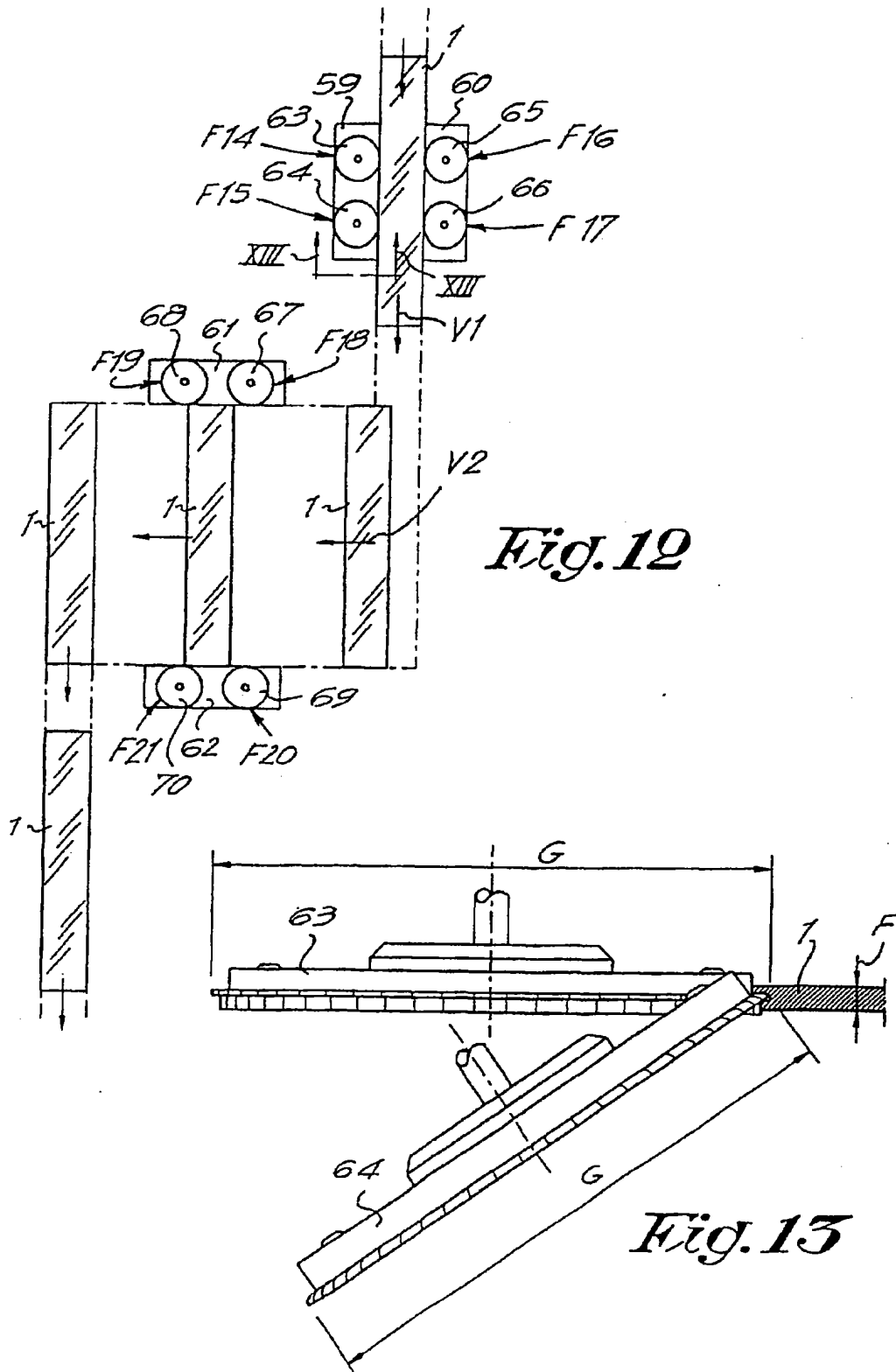


*Fig. 1*

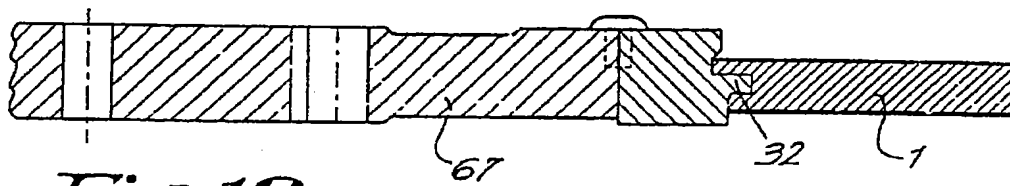
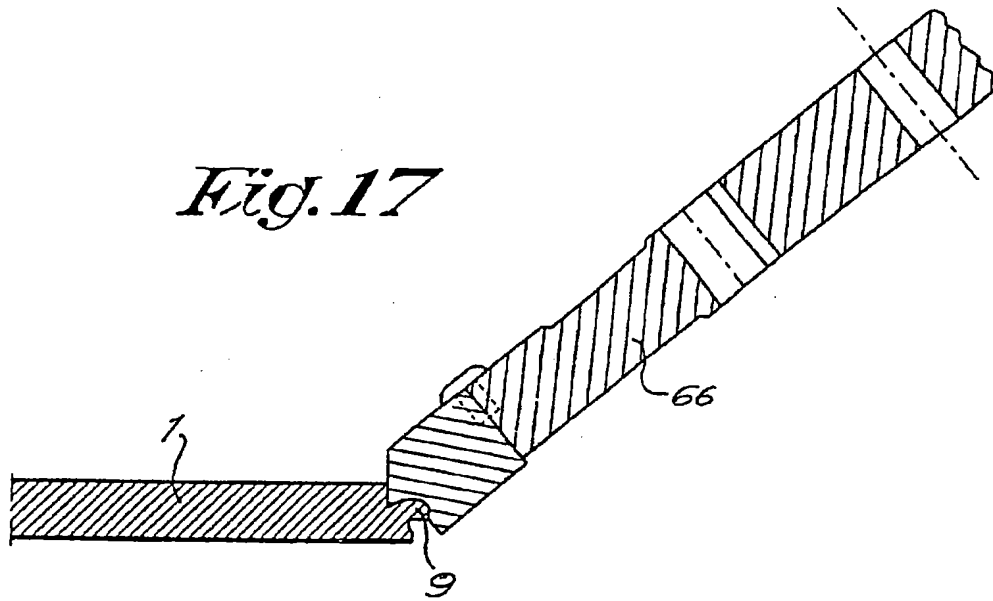


*Fig. 8*

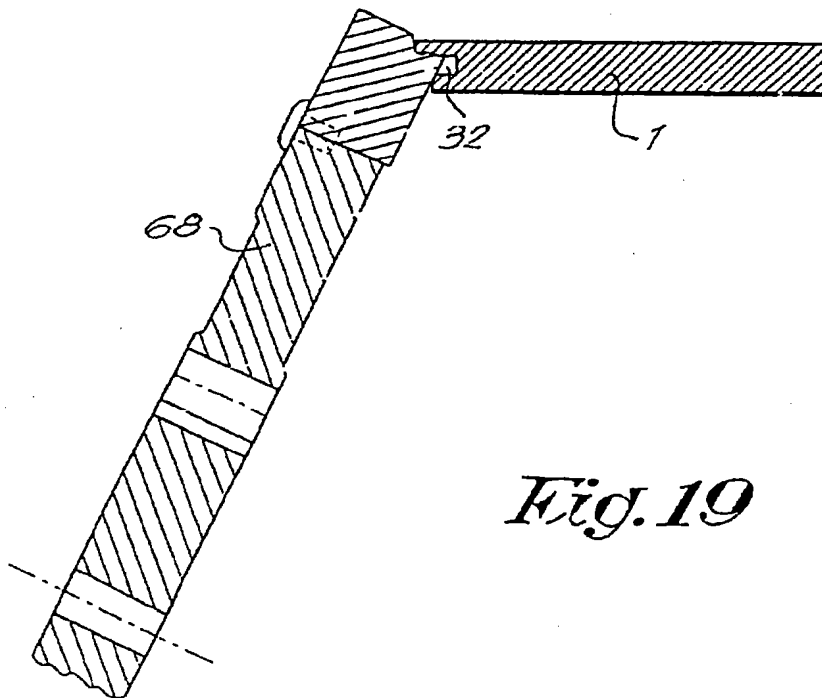




*Fig. 17*



*Fig. 18*



*Fig. 19*

